United States Department of Agriculture

Forest Service

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Subject: Assessment of Douglas-fir Failure At Sims Fire Ignition Site (FHP Rep. No. N09-08)

To: Tim Shannon, Special Agent, Klamath National Forest

At the request of Tim Shannon (Special Agent, Klamath National Forest), on August 3, 2009, Cynthia Snyder (Entomologist) and I examined a failed Douglas-fir (*Pseudotsuga menziesii*) near the ignition point of the Sims Fire above Highway 96 on the Happy Camp Ranger District of the Klamath National Forest. We also examined parts of the tree that were in a storage unit near the Klamath National Forest Headquarters in Yreka. Tim Shannon accompanied us on our visit. Objectives of the examinations were to document the condition of the Douglas-fir and determine what factors contributed to its failure. Our approach was to conduct a routine hazard inspection on the tree, as it would have appeared prior to the failure.

PROFESSIONAL QUALIFICATIONS

I have been a Plant Pathologist for the USDA Forest Service for 20 years. For 11 years, I've been stationed at the Forest Health Protection Shared Service Area Office in Redding, CA, serving the four National Forests and all federal lands in northwestern California. For just under 10 years prior to that, I served in a similar position in southwestern Colorado. My formal training in forest pathology includes MS and PhD degrees in Botany and Plant Pathology from Oregon State University in 1985 and 1989. Hazard tree evaluation is one of my specialty areas, and I provide professional advice and training regarding a wide variety of situations. I'm also the chair of the Western Forest Disease Work Conference Hazard Tree Committee.

Cynthia Snyder has served as Entomologist for the USDA Forest Service, Forest Health Protection Shared Service Area Office in Redding, CA for just under 2 years. Prior to that, she served as a Biological Technician for Forest Health Protection in Anchorage, Alaska for five years and for 10 years as a seasonal Biological Technician for Forest Health Protection in Missoula, Montana. Her formal training in forest entomology includes a MS degree in entomology from the University of Montana in 2003 and a BS in Forestry from Iowa State University in 1990.

As a team, Cynthia and I provide information and advice on a wide variety of disease and insect management situations.

OBSERVATIONS

Our first stop was at the storage unit in Yreka where two pieces of the subject tree were being

held. From the size of the pieces and what Tim Shannon told us, the tree had broken off about 5 or 6 feet above the ground line. The larger piece was from the break point to 4.2 feet below the break (Figure 1). The smaller piece was a 1.4-foot diameter, 0.5-foot thick cross section of the tree, taken immediately below the larger piece (Figure 2). Although the outer bark from both pieces was charred and had been removed from the sapwood, most of the pre-burn features of both the bark and the wood were still readily discernable. Extensive cubicle brown rot decay and evidence of wood boring insects, carpenter ants and wood boring beetles were noted in the wood (Figure 3). Although the decay was somewhat less pronounced at the base of the large piece and in the smaller cross section, the upper piece was almost completely decayed near the break point (Figure 4). Frass-packed holes and tunnels from wood boring insects were present throughout the two wood pieces, and were extensive even in the more solid parts near the base of the tree (Figure 5). Although the bark pieces had been charred, numerous wood borer exit holes on the outside of the bark could be easily seen (Figure 6). In addition to the evidence of decay and insect activity, a large callus ridge with inrolled bark was noted along the length of both pieces (Figures 2 and 7). This callus was likely the result of wounding caused by an earlier fire. By counting back the annual rings that had been produced since the callus started to form, it was determined that the fire scar (opening) was at least 12-17 years old. The last recorded fire in the area occurred in about 1987 (22 years ago).

Our next stop was at the ignition point of the fire, where the downed subject tree had been found. Except for the pieces that were taken to the Yreka storage facility, the downed Douglas-fir was still on the site. The tree was laying down the hill, perpendicular to the power lines (Figure 8). Measurements subsequently taken by Todd Drake (Forester, Happy Camp Ranger District, Klamath National Forest) show that the distance from the stump to the lower and upper power lines were 45.3 and 50.7 feet, respectively. The tree was 64-feet tall, well within the falling distance of the power lines. Fine needles were still present on the tree, indicating that it fell recently. However, a lack of fine needles on the residual branches in the top 14 feet of the tree indicates that it had a dead top. As was noted in the large piece at the Yreka storage facility, extensive cubical brown rot decay and wood borer activity was present at the break point, and extended at least 5-6-feet up the bole (Figure 9). Decay was noted in the stump as well, which before the failure, was below the pieces at the storage facility (Figure 10). At the top, the stump measured about 1.5 to 1.6-feet in diameter. A long fire scar, bordered with callus tissue was noted, running up from the break point to 9.6-feet above the break (Figures 11 and 12). A crack ran further up the bole from there. This was a continuation of the fire scar that was noted in the large bole piece in the storage facility. The wood along the fire scar was decayed. The position of the scar, which was on the uphill side of the bole before the tree failed, together with the presence of callus tissue, indicated that the scar was most likely caused by a fire that happened well before this summer's incident.

While inspecting the area, we noticed several other trees with pronounced fire scars. Below the downed Douglas-fir subject tree, we found two small standing oak and a larger oak stump with definite fire scars (Figure 13). Two more standing 12-inch DBH Douglas-fir with fire scars were found about 10-20-feet uphill from the subject tree (Figures 14 and 15). One also had a crack in it. The trees appeared tall enough to strike the power line if they fell.

DISCUSSION AND CONCLUSIONS

The subject Douglas-fir tree had extensive internal basal decay prior to its failure immediately before the Sims Fire. It is clearly evident that the structural capacity of the tree had been seriously compromised by decay and wood boring insects and it was tall enough to strike the power line when it fell. The presence of a fire scar and callus ridge, most likely from a fire in 1987, indicates that the decay fungus that rotted the tree had a readily available entryway into the tree for at least 22 years. In the course of a standard hazard tree evaluation, the presence of fire scars in trees in the area (which were present well before the 2009 fire) would have signaled the need for closer inspection to determine whether internal decay was present in trees within falling distance of the power line, and if so, how much. In the subject tree, visual inspection, sounding with an axe, and wood core sampling with an increment borer, would have revealed the extensive decay that led to its failure. Currently accepted guidelines (Wagener, 1963) require that a shell of sound sapwood equal to at least 1/3rd of the diameter of the tree be present to meet minimum safety standards. These standards were clearly not met.

In conclusion, it is apparent that if the subject Douglas-fir had been inspected by a qualified person prior to the failure, it would have received a high hazard rating. The high rating would have been based on the amount of readily detectable bole decay and the tree height relative to the power line. It would have been an obvious candidate for removal.

If you have any further questions regarding the observations and conclusions in this report, feel free to contact me at (530) 226-2436.

/s/ Pete Angwin
Plant Pathologist
Forest Health Protection
Northern California Shared Service Area

REFERENCE

Wagener, W.W. 1963. Judging hazards from native trees in California recreational areas: A guide for professional foresters. USDA Forest Service, Research Paper PSW-P1, 29p.

Figure 1. Piece of subject Douglas-fir from break point (top) to 4.2-feet below the break.

Figure 2. Cross-section of subject Douglas-fir subject tree taken immediately above the stump.

Figure 3. Decayed, insect-infested interior of subject Douglas-fir.

Figure 4. Decay near break point of subject Douglas-fir.

Figure 5. Frass-packed wood borer exit holes and tunnels in subject Douglas-fir.

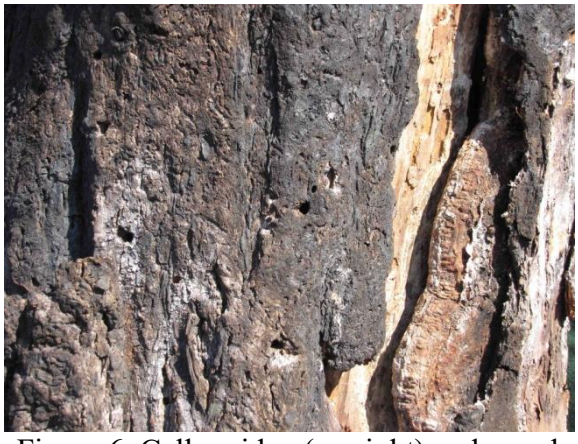

Figure 6. Callus ridge (on right) and wood borer exit holes on outside bark of subject Douglas-fir.

Figure 7. Decay and callus ridge along length of piece of subject Douglas-fir.

Figure 8. Downed subject tree at Sims Fire site.

Figure 9. Decayed bole above break point of subject Douglas-fir.

Figure 10. Stump of subject Douglas-fir. Note areas of decay on right.

Figure 11. Downed subject Douglas-fir with fire scar and callus ridge on right.

Figure 12. Close up of callus ridge at edge of fire scar on subject Douglas-fir. Note decayed wood along bottom of the photo.

Figure 13. Oak stump with fire scar near subject Douglas-fir.

Figure 14. Two Douglas-fir with fire scars uphill from subject Douglas-fir.

Figure 15. Fire scar at base of Douglas-fir uphill from subject Douglas-fir. Note crack in right side.